COURSE DESCRIPTION CARD - SYLLABUS

Course name
Experimental physics

Course

Field of study
Technical physics

Year/Semester
1/1

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
45

Laboratory classes

Other (e.g. online)

Tutorials
60

Projects/seminars

Number of credit points

8

Lecturers

Responsible for the course/lecturer:
dr hab. Jacek Goc, prof. nadzw.

e-mail: jacek.goc@put.poznan.pl

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of physics and mathematics (core curriculum for secondary schools, basic level) the ability to solve elementary problems in physics based on the acquired knowledge, the ability to obtain information from the indicated sources. Understanding the need to expand your competences, readiness to cooperate as part of the team.

Course objective

1. providing students with basic knowledge of classical physics, within the scope defined by the curriculum content appropriate for the field of Technical Physics

2. presenting students with basic physical phenomena and their theoretical description at the academic level in the field of mechanics, gravitational field, vibrations and waves in elastic media

3. developing students' skills to solve simple physical tasks and problems based on the acquired knowledge

4. improving students' literacy skills

Course-related learning outcomes

Knowledge

1. has an ordered and theoretically founded basic knowledge in the field of experimental physics including mechanics, fluid mechanics [K1_W03]

2. knows the mathematical apparatus necessary to describe the basic laws of physics and solve problems related to physics, including: the basics of differential and integral calculus, linear algebra and analytical geometry [K1_W01]

Skills

1. can use acquired mathematical knowledge to describe processes, create models, write algorithms in the field of technical physics; can use analytical methods to formulate and solve tasks in the field of measuring physical quantities [K1_U01]

2. is able to obtain information from literature, databases and other sources, interpret them and draw conclusions, formulate and justify opinions [K1_U02]

3. has the ability to self-educate [K1_U03]

Social competences

1. is able to work responsibly on the assigned task [K1_K01]

2. acts in accordance with the principles of professional ethics; is responsible for the reliability of the obtained results of their work and their interpretation [K1_K02]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Effect.	Form of evaluation. Evaluation criteria	
W01, W02, W03	written / oral examination	50.1% -70.0% (3)
U01, U02	written / oral examination	70.1% -90.0% (4)
	rating of answers to questions	from 90.1% (5)
U01, U02, U03	Colloquium	50.1% -70.0% (3)
		70.1% -90.0% (4)
		from 90.1% (5)
K01	Assessment of activity during calculation exercises	50.1% -70.0% (3)
		70.1% -90.0% (4)
		from 90.1% (5)

K01, K02, -student shows moderate commitment to solving

problems, are encouraged to look for a solution based on

acquired knowledge, to a limited extent engages in

implementation of accounting exercises

(3) -student shows commitment to problem solving,

actively looking for a solution based on the acquired knowledge

engages in the implementation of accounting exercises

(4) -student shows great commitment to problem solving,

independently looks for a solution based on the acquired knowledge,

looking for additional sources of knowledge useful to solve the problem,

(5) -student is actively involved in the implementation of accounting exercises, he is looking

solutions in non-standard situations

Programme content

1. Elements of thevectory account. Multiples and submultiples. Scalar and vector quantities in physics. Symbolic markings. Actions on vector quantities; geometric interpretation ..

2. Elements of the operatory account - as part of calculating exercises (scalar and vector field. Geometric interpretation of derivative and definite integral. Definition of field vector flux. Physical sense of gradient. Divergence and rotation).

3. Kinematics I. Absolute and relative motion. Reference systems. Leader vector. Parametric description of the motion of a material point. Coordinate systems. Road, speed and acceleration. Rectilinear motion, uniform and variable. Movement in the field of gravity.

4. Principles of material point dynamics. Newton's laws of motion I-III. The principle of conservation of momentum for a material point. Types of forces (interactions) in physics. Friction forces.

5. Work,power, mechanical energy. The principle of conservation of mechanical energy. Work and energy theorem. Conservative and non-conservative forces.

6. Discrete layout of material points. Center of Mass. Movement of the center of mass. The principle of conservation of momentum for a system in macroscopic and microscopic systems (collisions, jet propulsion).

7. Curve movement. Uniform motion in a circle. Velocity, angular velocity, normal and tangential acceleration in a circular motion.

8. Dynamics of rotory motion of a rigid body. Angular momentum, moment of force for a material point and a discrete system of material points, a rigid body in rotation. Moment of inertia of a rigid body. Moment of inertia tensor. Examples of calculating the angular momentum of solids with axial symmetry. Steiner theorem. Rotational movement of a rigid body.

9. Dynamics of the rigid solid. The principle of conservation of angular momentum. Free axes. Symmetrical bittern. Precessional movement, nutation. Gyroscopic effect. Analogies between the quantities describing translational and rotary motion.

10. Movement in non-inerial Reference systems. Real forces and apparent forces. Inertia forces in translational and rotary motion. Speed and acceleration in a rotating coordinate system. Coriolis acceleration and force (examples).

11. Statics and dynamics of liquids. Pressure, density. Pressure changes as a function of fluid depth. Archimedes' law. Pascal's law. Pressure measurement - barometer. Continuity equation. Bernoulli's equation. Dynamic lifting force. Viscosity of the liquid.

12. Gravity field. The law of universal gravitation. Kepler's laws of planetary motion. Weight. Inertial mass and gravitational mass. The intensity of the gravitational field.

13. Gravity field II. Changes in the acceleration of gravity. Movements of planets and satellites. Work in a gravitational field. The energy of the gravitational field. The potential of the gravitational field. Relationship between field intensity and potential

14. Elements of a particular theory of relativity. Inertial reference frames. The principle of relativity. Galileo transformation. The Michelson-Morley experiment. Lorentz transformation.

15. consequences of Lorentz transformation. The extension of time, the shortening of the length, the relativity of simultaneity, the invariance of the space-time interval.

16. Relativist dynamics. Speed transformation. Momentum and relativistic energy. Mass and energy equivalence.

17. Elastic properties of bodies. Hooke's Law.

18.Mechanical vibrationsI. Simple harmonic motion. A mathematical and physical pendulum. Energy of simple harmonic motion.

19. Mechanical vibrations II. Damped harmonic movement. Forced vibrations, resonance. Composition of harmonic movements.

20. Waves in elastic centers. Types of waves. Differential wave equation and its solution. Wave interference. Standing waves. Group and phase speed.

21. Elements of acoustics. Audible sound waves, ultrasound and infrasound. Tones and sounds. Sound volume. Beats - amplitude modulation. Principle of superposition (Fourier decomposition). Doppler phenomenon.

Teaching methods

1. Lecture: a multimedia presentation, illustrated with the examples given on the blackboard and the presented experiences.

2. Exercises, multimedia presentation, presentation illustrated with examples given on the blackboard and carrying out the tasks given by the lecturers - practical exercises.

Bibliography

Basic

1. D. Halliday, R. Resnick, J. Walker, Podstawy Fizyki, t. 1 i 2, PWN 2004
2. C. Kittel, W.D.Knight, M.A.Ruderman, Mechanika (Berkley Phys. Cours), PWN 1975
3. B. Fabiański, Z. Paczkowski: Zbiór zadań z fizyki, Warszawski Dom Wydawniczy 2000
4. J. Araminowicz: Zbiór zadań z fizyki, PWN 1998
5. A. Hennel, W. Krzyżanowski, W. Suszkiewicz, K. Wódkiewicz: Zadania i problemy z fizyki Tom 1PWN 1974

Additional

1. R. P. Feynman i inni, Feynmana wykłady z fizyki, PWN 1971.
2. A. Piekara, Mechanika ogólna, PWN 1967.
3. S. Szczeniowski, Fizyka doświadczalna, PWN 1972.

Breakdown of average student's workload

	Hours	ECTS
Total workload	210	8,0
Classes requiring direct contact with the teacher	126	4,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	108	4,0

[1] delete or add other activities as appropriate